GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Advanced Mathematics, PG_00047393		
Field of study	Electronics and Telecommunications		
Date of commencement of studies	October 2022	Academic year of realisation of subject	2022/2023
Education level	second-cycle studies	Subject group	Obligatory subject group in the field of study Subject group related to scientific research in the field of study
Mode of study	Full-time studies	Mode of delivery	at the university
Year of study	1	Language of instruction	English
Semester of study	2	ECTS credits	6.0
Learning profile	general academic profile	Assessment form	exam
Conducting unit	Mathematics Center -> Vice-Rector for Education		
Name and surname of lecturer (lecturers)	Subject supervisor	dr Magdalena Musielak	
	Teachers	dr Magdalena Musielak	

Lesson types and methods of instruction

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	30.0	15.0	0.0	0.0	0.0	45
E-learning hours included: 0.0						

Learning activity and number of study hours

Learning activity	Participation in didactic classes included in study plan	Participation in consultation hours	Self-study	SUM
Number of study hours	45	15.0	90.0	150

Subject objectives

The use of specialized mathematical tools to technical subjects.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_U01] can apply mathematical knowledge to formulate and solve complex and non-typical problems related to the field of study by:n- appropriate selection of source information and its critical analysis, synthesis, creative interpretation and presentation,n- application of appropriate methods and toolsn	Student uses the notion of linear space, linear transformation, determines matrices of linear transformations in different bases, demonstrates methods for solving differential and integral equations, analyzes stability of linear and nonlinear systems of differential equations.	[SU4] Assessment of ability to use methods and tools
[K7_W01] Knows and understands, to an increased extent, mathematics to the extent necessary to formulate and solve complex issues related to the field of study.	Student knows the basic concepts and theorems of linear algebra, knows the basics of functional analysis, knows the types of differential and integral equations, knows theorems and techniques of solving ordinary differential equations and partial differential equations.	[SW1] Assessment of factual knowledge

<table>
<tr><td>Subject contents</td><td>Linear space. Basic concepts. Linear subspace. Basis and dimension of linear space. Coordinates of vector to the base. Linear operators. Basic concepts. Matrix of linear transformation. Change of basis matrix. Hilbert Space. Space $L^2[-,]$.

First order ordinary differential equations. Basic concepts. Separable equations. Bernoulli equation. Lagrange equation and Clairauta equation. Exact equations. Intergrating factor. Second order equations reducible to first order. Higher order linear equations with constant coefficients. Higher order Euler equations. Second order linear equations with nonconstant coefficients. Systems of differential equations.Qualitative analysis of solutions of ordinary differential equations. Lapunov stability.

Integral equations. Basic terminology. Classification. Volterra and Fredholm equation. Transforming differential equations into integral equations. Methods for solving integral equations. Successive approximations, iterated kernels, resolvent.

Partial differential equations. Basic concepts. First order partial differential equations. Linear partial differential equations of second order. Methods to solve linear partial differential equations of second order. Classification of equations. Reducing equations to canonical form. Wave equation in one dimensional case. Wave equation. Heat conduction equation. Laplace equation.</td></tr>
<tr><td>Prerequisites and co-requisites</td><td></td></tr>
<tr><td>Assessment methods and criteria</td><td>
<table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>Written examination</td><td>50.0%</td><td>80.0%</td></tr>
<tr><td>Homework assignments</td><td>0.0%</td><td>20.0%</td></tr>
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<tr><td>Recommended reading</td><td>
<table>
<tr><td>Basic literature</td><td>1. Roman, S., Advanced Linear Algebra, Third Edition, Springer
2. Tveito, A., Winther, R., Introduction to Partial Differential Equations, Springer
3. L. C. Evans, Partial Differential Equations, AMS.
4. Hochstadt, H., Integral Equations, A Wiley-Interscience Publications
5. M.I.Krasnov, G.I.Makarenko, A.I. Kiselev, Problems and exercises in the calculus of variations., Mir Publishers.
6. Debnath, L., Mikusinski, P., Hilbert Spaces with Applications, Third Edition, Elsevier Academic Press</td></tr>
<tr><td>Supplementary literature</td><td>1. Simmons, George F., Differential equations with applications and historical notes, Third Edition, CRC Press, Taylor & Francis Group
2. Asmar, Nakhle H., Partial Differential Equations and Boundary Value Problems with Fourier Series, 2nd Edition, Pearson</td></tr>
<tr><td>eResources addresses</td><td>Adresy na platformie eNauczanie:</td></tr>
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<tr><td>Example issues/ example questions/ tasks being completed</td><td>1. Verify if the given transformation $T : R_{2x2}R_2[x]$ is linear. In case of positive answer find ker T, im T, dim ker T, dim im T. T ([a b; c d])= $ax^2+(b-c)x +d$ ($R_{2x2},+,\cdot$) vector space of real matrices of order 2, with addition and scalar multiplications, ($R_2[x],+,\cdot$) vector space of real polynomials of order at most 2, with addition and scalar multiplications.)
2. Solve the following nonhomogeneous linear equation. y'''+y''=(x-1)/(x^2).
3. Examine stability of equilibrium points of the system {x'=xy+2y^2; y'=(y-1)(x+2)
4. Find the integral surface passing through given curve (u)/(x) + y (u)/(y)=u^2y, y=t, y=t^2, u=1.
5. Classify the equation and find its characteristics (^{2} u)/(x^2) - 2 cos x (^{2} u)/(x y) -(3 +sin^2 x) (^{2} u)/(l y^2) -y (u)/(y)=0.
6. Find the resolvent kernel, if $K(x,t)=x^2 t^2$; a=-1, b=1.</td></tr>
<tr><td>Work placement</td><td>Not applicable</td></tr>
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